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BIOLOGICAL EVALUATION OF THE POLLUTION STATUS OF MASSEY CREEK AND VICINITY NEAR SKEAD ONTARIO.

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Biological evaluation of the pollution status of Massey Creek and vicinity near Skead Ontario / Conroy, Nels.

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BIOLOGICAL EVALUATION OF THE POLLUTION STATUS OF MASSEY CREEK AND VICINITY NEAR SKEAD ONTARIO.

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Report Prepared
by

Nels Conroy
Regional Biologist

and

W. Keller
Field Technician

Water Quality Branch
Water Resources Division
Ministry of the Environment

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I N T R O D U C T I O N

In the summer of 1970, information was received by the Ontario Water Resources Commission indicating that the stream ecology was impaired in Massey Creek and in a small unnamed creek flowing through the MacLennan Mine property near Skead, Ontario. It was inferred that Massey Creek, a well known speckled trout creek, was no longer suitable habitat for this species of fish. Massey Creek and Bowlands Bay Creek flow into Lake Wanapitei, thus concern was expressed that if water quality in these creeks was impaired the lake in time could be adversely affected. A biological survey of these creeks was subsequently carried out (Conroy, 1970). The results of that survey are summarized below.

1. Biological conditions in Massey Creek appeared to be generally depressed.
2. No influence on stream ecology was found from either MacLennan Mine or the abandoned Nickel Rim Mine.
3. No cause for the apparent depressed biological conditions could be attributed to water quality parameters which were investigated.
4. It was hypothesized that the depressed biological conditions might be attributable to a

severe flooding condition which occurred in the Sudbury District prior to the survey in 1970.

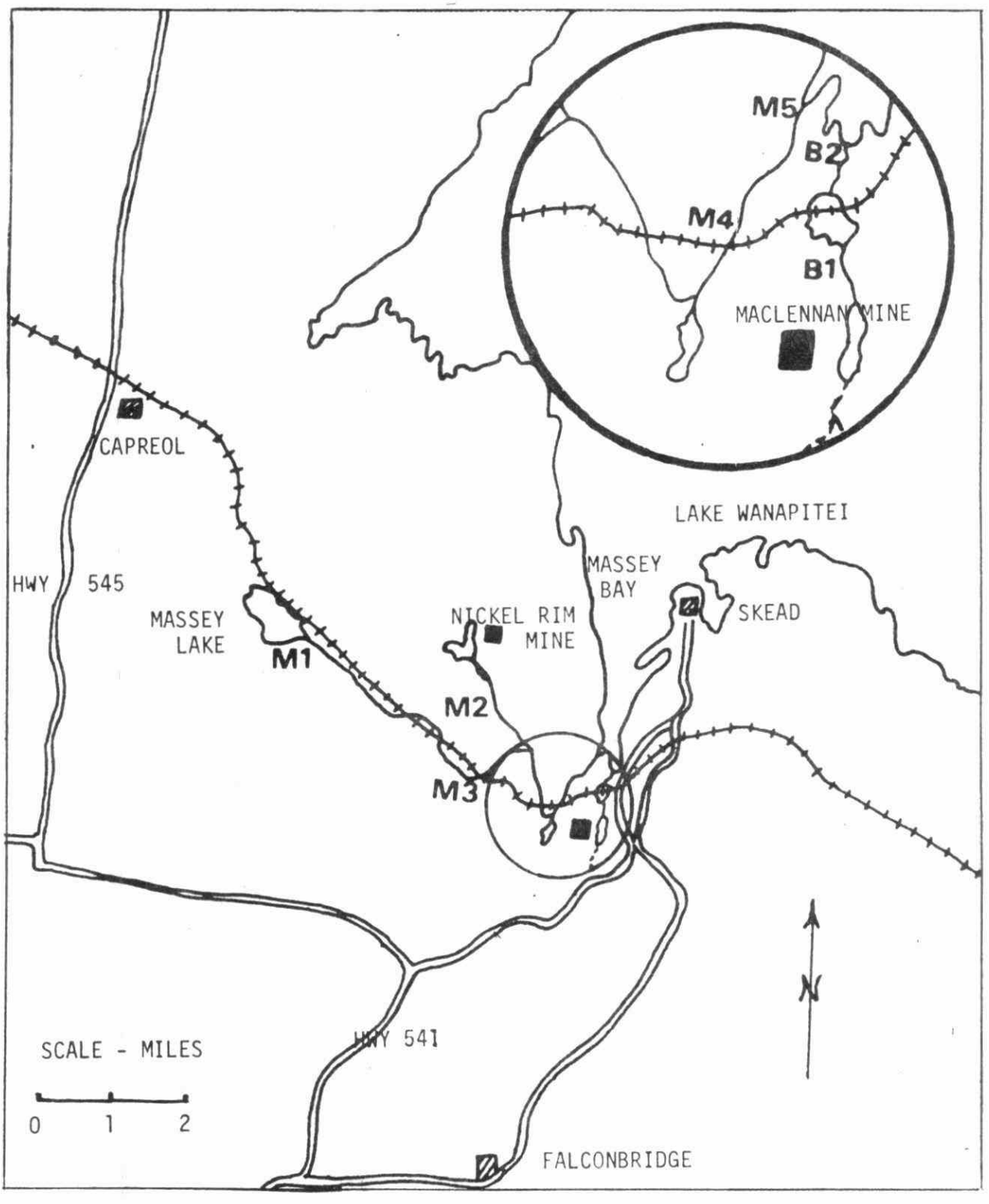
To substantiate the results of the 1970 survey, a parallel survey was undertaken in mid-July 1971, utilizing the same stations as in the 1970 survey (see figure 1). This report outlines the results of the 1971 survey and compares the data for 1970 and 1971.

STUDY AREA

The watersheds investigated are located near the village of Skead, approximately twenty miles north of Sudbury, Ontario. Seven locations were sampled in this study (see figure 1). Stations M1, M3, M4, and M5 were on Massey Creek. Station M2 was on a small stream flowing through the abandoned Nickel Rim Mine Property. Stations B1 and B2 were on the small stream flowing through the MacLennan Mine property.

The creeks flowing through the Nickel Rim Mine and and MacLennan Mine properties have been designated Nickel Rim Creek and Bowlands Bay Creek respectively for purposes of this report.

FIGURE 1. SKETCH MAP OF STUDY AREA SHOWING SAMPLING STATIONS



METHODS

Biological

Stations consisted of riffle areas the width of the stream and several yards long. Riffle areas were selected to minimize the natural differences in aquatic bottom fauna related to habitat variation.

Bottom fauna communities were investigated at each station by washing portions of the gravel bottom into small mesh hand sieves placed immediately downstream. A total of one-half hour man effort per station was employed to collect a representative sample of the bottom fauna community. The organism collected were picked from the sieves and preserved in ethanol for subsequent identification.

In addition to bottom sampling, during the 1971 survey an attempt was made to determine the presence or absence of fish in the water-course. For this purpose a minimal amount of gillnet (fifty feet of 2½ inch mesh) was set overnight in a pond near station M4.

Chemical

At each station two 1-litre glass bottles of water were collected for sulphate and metals analyses at the O.W.R.C. laboratory in Toronto. Samples for metal analyses were preserved with 2 ml of concentrated nitric acid. Measurements of pH, conductivity, dissolved oxygen concentration and temperature were performed in the field.

RESULTS AND INTERPRETATION

Biological

Table 1 summarizes the results of bottom fauna surveys for 1970 and 1971. During the 1970 survey, bottom fauna communities in Massey Creek appeared generally suppressed. In 1971, communities more typical of a normal stream environment were found. Almost invariably, the sampling sites contained a greater number and variety of bottom organisms in 1971 than in 1970. Many bottom fauna species not found in 1970 were present in 1971, including pollution-sensitive immature mayflies, alderflies, and dragonflies, as well as amphipods and worms.

In both surveys, station M2 (Nickel Rim Creek) and station M3 (Massey Creek above the confluence with Nickel Rim Creek) showed the poorest bottom fauna populations, while station M4 and M5 (Massey Creek below the confluence with Nickel Rim Creek) and B1 and B2 (Bowlands Bay Creek) contained larger and more diverse communities.

An overnight gillnet set in a pond near station M4 yielded thirteen brook trout (½ to 3½ pounds) and seventeen suckers. All fish captured were in prime condition. It was noted that the trout had been feeding exclusively on amphipods.

TABLE 1 RESULTS OF BOTTOM FAUNA SAMPLING JULY 2, 1972 and JULY 17, 1972

TAXA	STATION													
	M1		M2		M3		M4		M5		B1		B2	
	1970	1971	1970	1971	1970	1971	1970	1971	1970	1971	1970	1971	1970	1971
Mayfly										1				
Midge	12	22	3	1		1		19	12	11	16	7	4	15
Midge (pupae)		2								1				
Mosquito				1										
Blackfly							30	423	27	8	30	744	60	567
Blackfly (pupae)												2		
Other Diptera								3		1				4
Other Diptera (pupae)				1						1				
Caddis			1				12	5	8	10	3	1	12	3
Alderfly														1
Amphipod						1		1						1
Dragonfly		2												
Worm		2						2				1		
Beetle (adult)	4					1							1	
Minnow	Ø								Ø				Ø	Ø
Crayfish	Ø					Ø							Ø	
Leech														1
Snail								1						

Ø = observed

PHYSICAL AND CHEMICAL

The results of analyses of water samples collected on July 2, 1970 and July 17, 1971, are given in tables 2 and 3.

No significant water-borne concentrations of zinc, copper, nickel or lead were detected in Massey Creek in 1970 or 1971 while samples from Nickel Rim Creek contained significant concentrations of zinc, copper and nickel during both investigations. Nickel concentrations in Bowlands Bay Creek ranged from 0.1 to 0.29 mg/l at stations B2 and B1, respectively,in 1971. Other metals (excepting iron) were below the limit of detection.

Elevated sulphate concentrations occurred at stations B1 and B2 on both sampling dates (70-95 mg/l). At stations M2, M4 and M5 large increases in sulphate concentrations were noted in 1971. With the exception of Station M1, pH measurements were somewhat higher in 1971 than in 1970. Extremely low pH was found only at station M2 on Nickel Rim Creek (3.7 and 3.8 for 1970 and 1971 respectively). The pH at stations on Massey Creek varied from 5.8 to 6.8 in 1970 and 5.3 to 7.5 in 1971. The pH of Bowlands Bay Creek varied from 7.2 to 7.3 in 1970 and 7.3 to 8.1 in 1971.

In comparison to the corresponding period in 1970, dissolved oxygen concentrations were significantly reduced at all stations during 1971. Water temperatures were similarly reduced during 1971, especially at station M4 which had a temperature of 20°C on July 2, 1970 and 10°C on July 17, 1971. These changes in dissolved oxygen and temperature are to be expected owing to the yearly changes in active impoundment sites (beaver dams) and the resultant changes in natural organic loadings above these impoundments.

TABLE 2 RESULTS OF CHEMICAL ANALYSES OF WATER

July 2, 1970 and July 17, 1971

STATION	pH		TEMP. °C.		DISSOLVED OXYGEN mg/l		SULPHATES mg/l	
	1970	1971	1970	1971	1970	1971	1970	1971
M1	5.8	5.3	18	18.5	12	4	16	13
M2	3.7	3.8	18	14	13	6	10	148
M3	6.4	6.9	19	18.5	12	6.5	22	26
M4	6.0	7.1	20	10	15	8	10	108
M5	6.8	7.5	17	11.5	15	7.5	8	120
B1	7.2	7.2	21	17.5	15	7.5	95	87
B2	7.3	8.1	22	19.5	11	7.5	70	78

TABLE 3 RESULTS OF SELECTED METALS ANALYSES

JULY 17, 1972

STATION	Zinc mg/l	Copper mg/l	Nickel mg/l	Lead mg/l	Iron mg/l
M1	N.D.	N.D.	N.D.	N.D.	2.1
M2	0.07	0.08	0.81	N.D.	0.80
M3	0.02	N.D.	N.D.	N.D.	1.1
M4	N.D.	N.D.	N.D.	N.D.	0.20
M5	N.D.	N.D.	N.D.	N.D.	0.45
B1	N.D.	N.D.	0.29	N.D.	0.05
B2	N.D.	N.D.	0.10	N.D.	0.05

N.D. - not detectable

CONCLUSIONS

1. The water quality of Nickel Rim Creek was impaired due to the influence of the abandoned Nickel Rim Mine tailings area.

2. Slight impairment of water quality in Massey Creek due to the effects of impaired water from Nickel Rim Creek was detectable.

3. No impairment of biological conditions in Massey Creek or Bowlands Bay Creek was attributed to MacLennan or Nickel Rim Mine.

4. Bottom fauna communities investigated in 1971 had in most cases improved considerably from those found in 1970.

5. Reaches of Massey Creek which are suitable as brook trout habitat in terms of temperature and dissolved oxygen appear to harbour good populations of this species. Since the watershed is dynamic because of the regeneration of forests from periodic forest fires, beaver activity, and perhaps sulphur fume effects on vegetation, the suitability of areas in various reaches of the stream for trout can be expected to change.

6. No evidence was found to suggest that the quality of water entering Lake Wanapitei from either Bowlands Bay Creek or Massey Creek could be adversely affecting the quality of water in that lake.

RECOMMENDATIONS

1. The abandoned tailings area on the Nickel Rim property should be stabilized and the water in Nickel Rim Creek treated to elevate its pH to within the 6.5 - 8.5 pH range considered suitable for protection of fish and other aquatic life.

2. Periodic sampling should be continued at station B2 to provide early indication of any adverse changes which might occur in the water quality of Bowlands Bay Creek. Attention should be given to analyzing for pH, sulphate and nickel concentrations at these stations.

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